THE LAND

TODAY AND TOMORROW

IS TERRACING ENOUGH?

By T.B. Chambers

OFFICIAL
BULLETIN

U.S. SOIL EROSION SERVICE
DEPARTMENT OF THE INTERIOR

VOLUME 1
NO. 3

DECEMBER
1934

THE LAND
TODAY AND TOMORROW

Issued Monthly by the
U. S. SOIL EROSION SERVICE
DEPARTMENT OF THE INTERIOR

Harold L. Ickes
SECRETARY OF THE INTERIOR

H. H. Bennett
DIRECTOR, SOIL EROSION SERVICE

Editors
G. A. Barnes Ewing Jones

The Contents

Cover Design by Miss Elizabeth Osgood, Drafting Section

PROJECT WORRIES

Urbana, Illinois

Cowpaths rapidly become gulches in the deep soils of Illinois.

Waterfall erosion is whittling wide and deep into the heart of Illinois fertile soils. Gullies practically have ruined this field.

Is Terracing Enough?

By T. B. Chambers

ASSISTANT TO CHIEF ENGINEER

The Soil Erosion Service says no —and here Mr. Chambers points out why. Terracing, he explains, is a vital factor in erosion control—but not the sole solution.

In view of a rapidly expanding interest in measures of erosion control, it is timely to present a statement on the subject of terracing and define the construction, functions and values of terraces as one of the implements of combat against severe land wastage.

If terraces are properly laid out, and properly constructed and maintained on selected lands adapted to their use, they are very effective in the control of gullying and reduction of sheet erosion, as well as useful in encouraging contour cultivation and strip cropping. They must be considered a very helpful, practical approach to the problem of soil erosion control. But on the other hand, they must not be regarded as the sole effective measure of prevention. They are, barring exceptional circumstances, only one factor in a properly coordinated control program.

The purpose of a terrace, stated simply, is to help prevent erosion by: (a) intercepting runoff from rainfall in its course down a cultivated slope, and (b) conducting excess water away from the field at a velocity that produces a minimum of erosion. However, there are supplementary purposes which assume more or less importance under varying conditions of climate and land use. For instance, in regions of dry farming it is customary to construct level terraces, or level terraces closed at the ends, to assist in conserving moisture. In most instances, conservation of the soil is the principal purpose, but on certain very gently sloping or level lands in the sub-humid region, conservation of rainfall may be the primary aim.

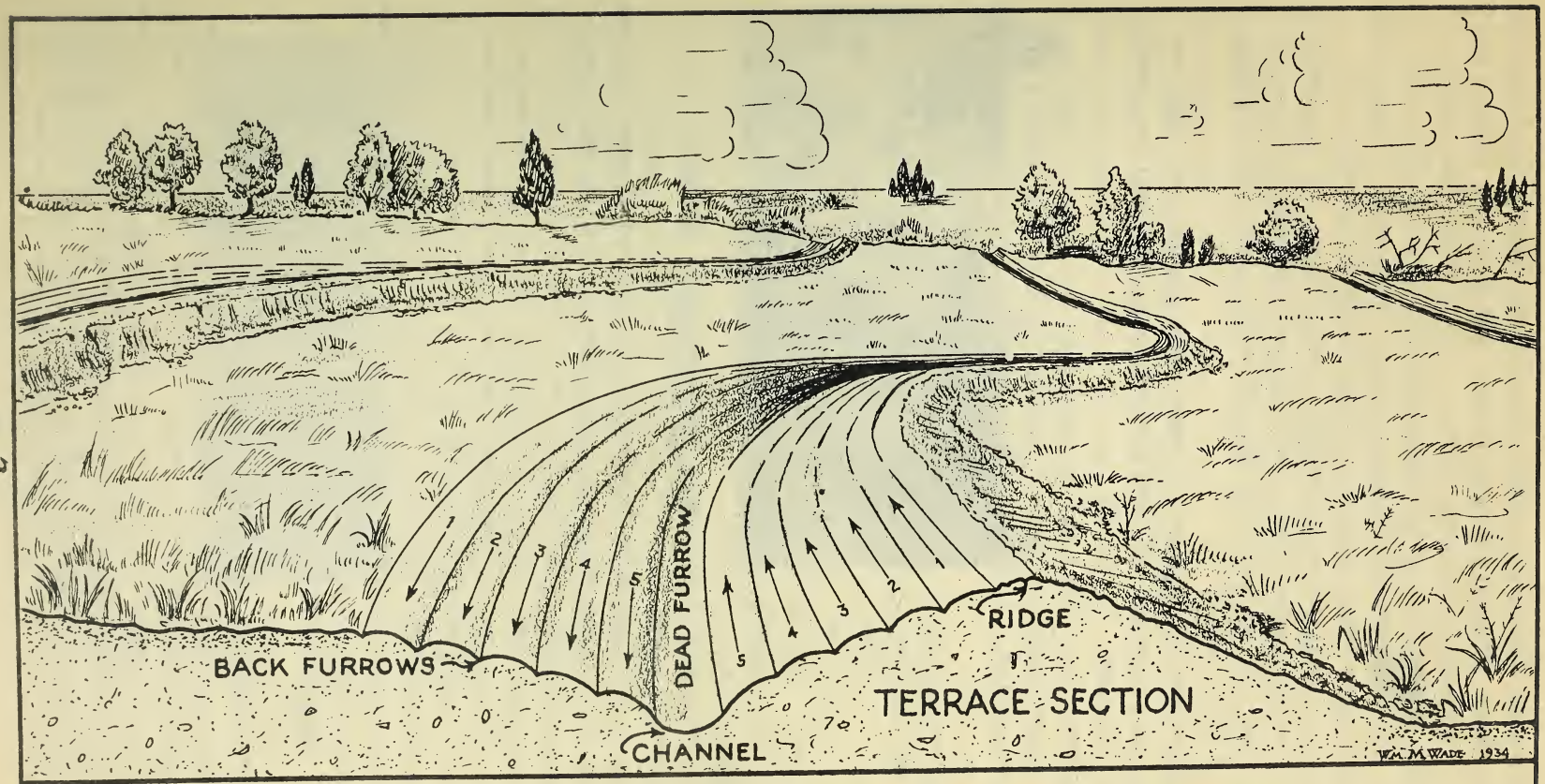
Many fallacious views have arisen with regard to the functions of a terrace and the results to be expected from its use. It has been stated that terracing, as a perfect method of controlling erosion, is self sufficient. Results from the ten Soil Erosion Experiment Stations located on as many different soil types in the principal farming regions of the United States show that soil loss from terraced areas is reduced in an important degree as compared with unterraced areas. This is an obvious fact, as is also the fact that efficient terracing is a practical measure for minimizing erosion. Some of the measurements referred to might easily be misleading, however, owing to the method by which they have been made. The soil removed from the slope is measured at the outlet end of the terrace. No accompanying figures are available to show how much additional soil is removed from the area between terraces, intercepted by the lower terrace and dropped into the channel, where it is allowed to remain until the channel is dangerously choked, and later, by a process of maintenance, removed to the top of the ridge, where the same process is repeated.

It is true, of course, that soil movement is retarded by the terrace system. Instead of a great quantity of topsoil being swept away directly as the result of a heavy downpour as frequently happens in unterraced fields, a much smaller amount is carried immediately out of the field. Generally a considerably larger quantity is intercepted, at least for a while, by the terrace embankment. The result then is not a perfect system of erosion control, but a foundation on which a better system may be erected, as will be pointed out below.

KINDS OF TERRACES

Only the broad-base terrace is being constructed by the Soil Erosion Service. This type is adaptable to cultivation on slopes that are not too steep, since it does not have the steep side-slopes of the narrow-ridge terrace.

Several types of broad-base terraces are in general use, all of which are a modification of the Mangum Terrace (devised on the farm of Mr. Priestly Mangum, some forty years ago, near Wake Forest, N.C.). The old type Mangum Terrace, constructed by moving equal amounts of soil from the upper and lower sides of the ridge, has generally been abandoned due to the small water channel formed on the upper side. A modification of this type, composed of a broad, flat water channel above the terrace ridge, is now most generally used. From 75 to 100 percent of the material generally is moved from the upper side, the amount increasing with the steepness of the slope. The broad, flat channel is of sufficient capacity to care for the runoff from ordinary storms, and the ridge is a safety factor for unusual rains.



METHOD OF MAINTAINING TERRACES BY PLOWING

ARROWS INDICATE THE DIRECTION IN WHICH FURROWS ARE MADE

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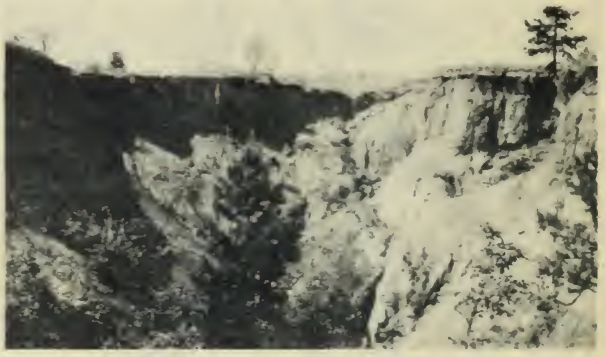
The narrow-ridge type, sometimes locally referred to as one-row terraces, which formerly was so common in the South, is rapidly giving way to the modified Mangum Terrace. The narrow-ridge type is susceptible to damage by percolation when carrying its full capacity of water. To overcome this danger, such terraces must be constructed with an excessive grade, such as induces scouring, otherwise the ridge must be stabilized with permanent vegetation. It is generally impossible to cultivate across the steep, narrow ridges without destroying them, but the practice of cultivating over the broad-base terrace is quite common.

Terraces must be designed to meet local conditions. Such factors as slope, climate, soil and cultural practices must be considered. In the more humid regions, the terrace channel must be constructed for maximum capacity, and on comparatively gentle, non-erosive gradients. In establishing a balance between channel capacity and quantity of runoff it is necessary to place the terraces at closer intervals. Consequently, as the land slope increases, the interval between terraces decreases. Soil characteristics, particularly erosivity and permeability, must influence the design of the terrace system. The ability of soil to absorb water should not generally influence the design to any great extent, since a condition sometimes arises where the surface soil is saturated at the beginning of a heavy rainfall, so that runoff is approximately equivalent to that from an impervious soil.



Gully caused by washing in improperly protected terrace outlet.

Under conditions of low rainfall, it is often imperative to conserve as much moisture as possible, and to this end the terrace should be constructed on the level and at greater horizontal intervals.

Terrace gradings fall under three general classifications, namely: level, uniform and variable. The level terrace is most commonly used in the drier regions, where its primary function is water conservation. A terrace channel of uniform gradient produces maximum discharge in a comparatively short time after precipitation begins, and has other objectionable features. A terrace channel of variable grading begins with the flatter gradients (or with no slope at all)

at the upper end and increases with units of length toward the outlet. This effects a more gradual and favorable discharge rate, and it is the type most generally used by the Soil Erosion Service.

In the past, most farmers using terraces have done their own work. The amount of equipment was necessarily limited, generally to a plow, Martin ditcher or home-made drag, all horse-drawn. The expenditure of time and labor was excessive and quite often resulted in the work being discontinued before adequate cross-section of ridges and water channel had been attained. Frequently, the gradients were imperfect, often too steep.

Machinery consisting of tractor-operated terracing blade graders, that makes terrace construction much more economical, has been developed in recent years, and is in general use on cooperative projects. Realizing the necessity of economical construction, this heavy equipment is being extensively used by the Soil Erosion Service. Heavy elevating graders have proven economical under conditions of long uniform flat slopes.

Since the projects of the Soil Erosion Service are demonstrational, a number of the horse-drawn machines are furnished each project and their use taught to individual cooperators.

DANGERS OF TERRACING

Improper terracing involves dangers which should be carefully considered. Too often we see fields ruined by gullies which have been caused directly by improperly constructed terraces or terrace outlets with inadequate protection. In numerous instances, the failure can be traced directly to faulty construction. In other instances, failure has come about because the designer did not properly evaluate all the conditions influencing the successful operation of the complete system, such as excessively steep slopes, shallow surface soil over impervious clay, and highly erosive soil. The chief faults of improper construction are: (a) inadequate size of channel and ridge, such as induce overtopping and consequent cutting of the ridge, with resultant scouring and gullying; excessive gradients that produce erosion in the

A terraced field.

Continued on Page 24

Fifty Years Finished the Mayans

A flourishing civilization perished in half a century — choked with the products of its own erosion. Could such a disaster overtake the United States?

By P. H. Walser

EXTENSION AGENT LINDALE PROJECT

What mysterious cause brought about the fall of the Mayan empire which flourished for about twelve centuries in Central America in what are now the tropical jungles of Guatamala?

The Mayans, numbering about 14 million persons, are not known to have been wiped out by the superior strength of an invading enemy. They were probably unconquerable in their day. Their temples and public buildings had been in ruins for nine centuries before the conquering Spaniards under Cortez wiped out most of the few records concerning them which then remained. There is no evidence that their civilization was destroyed by an earthquake, tidal wave, storm, or by fire. But we do know that in the fifty years between 580 and 630 A.D. this marvelous civilization suddenly disappeared, leaving no reminder but a few ruins. The very site of their great empire was deserted by their survivors and descendants.

Scientists have since dug into their ruins, examined their descendants, studied their language, and patiently pieced together their history in the effort to solve the baffling mystery of their disappearance. All solutions advanced, however, were no more than mere guesswork until an American geologist, Dr. C. Wythe Cooke, hit upon the reason for the fall of their empire and gathered the necessary data to support his conclusions.

Dr. Cooke found the secret in the swamps or bogs which constitute about forty per cent of their territory at present. He made a close study of the soil formation in these bogs and on the lofty hills which surround them. From this examination he came to the conclusion

that what are now bogs and flat, muddy plains were immense, clear lakes in the days of Mayan civilization. The eroded hills now covered with mahogany and chicle trees, were fertile farms of rich black soil. On these farms they produced their bountiful crops, and carrying them down the hills on their backs -- they did not use beasts of burden and had never discovered the principle of the wheel -- they put their products on boats and exchanged goods with each other across their lakes. With rich soil to draw on, with lakes as a means of transportation, and with their ingenious minds directing, they built up a civilization unaided, for they did not have the history of all previous civilizations to draw on.

Life flowed smoothly for them until their farmers, spurred on by the demand for more agricultural goods caused by an increasing population, cleared more and more of the uplands for cultivation and thereby exposed increasing amounts of the black soil to the torrential rains which fall in that climate six months out of the year. Erosion set in, and as the Mayans knew no way to stop it, the inevitable happened. The rich soil was carried down hill in torrents, baring the farms to the subsoil. After a time it was no longer possible to feed the millions of people in the valleys below or even to support the farm families. The soil which left the hills silted up the lakes below, interfered with and in time stopped the interchange of goods on these lakes.

Says Dr. E. E. Free, in his *"Week's Science"* (New York):

"The Maya civilization choked itself to death, Dr. Cooke believes, with mud washed from its own hillside corn patches. The former Maya country is marked today, Dr. Cooke reports, by small, flat plains of sticky clay soil, almost impassable in wet weather. Each of these plains, he believes, once was a small lake, these lakes being connected by streams or by short portages forming a system of water highways as the lakes of North America once did for the canoes of the Indians. The Maya cities, he believes, were built near these lake highways, and maintained by this easy form of transportation. On nearby hillsides, the theory continues, the Maya farmers grew the corn, which was their chief food. In so doing they cut or burned the natural hillside vegetation. The result was that every violent rainstorm washed a part of the hillside soil down into the lakes. Slowly the lakes filled up and the hillsides grew bare. The filling of the lakes blocked the waterways, while erosion of the hillside soils ruined the farms and lowered the nation's supply of food."

Soil gone and commerce gone, the people were reduced to a state of poverty. But, as Dr. Cooke has pointed out, something else is

necessary to explain the almost complete wiping out of the population, which is known to have occurred within the short space of fifty years. That something was disease -- malaria and yellow fever -- which arose and spread as soon as the lakes and lowlands were converted into mosquito breeding bogs Not knowing how to control either disease, there was nothing for the Mayans to do but flee the country. A few thousands of their survivors may yet be found in Yucatan, Guatemala, Honduras, and other parts of Central America.

Could such a thing as this happen to the United States? Instinctively, we say no. The idea is too repulsive for us to want to consider it. But sober reflection will show that just that is happening in the United States now. Hills wholly or partly stripped of their fertile top soil have become too commonplace to provoke comment. The steady sanding over of rich meadows with soil from above is a sight almost as common. The silting up of lakes which cities build to provide themselves with water goes on so rapidly that the lakes are filled almost before the bonds issued for their construction have been retired.

The United States has already lost through soil erosion not less than 35 million acres of good farm land, according to Director H. H. Bennett, who further estimates that 100,000 acres of land are being abandoned each year as no longer worth cultivating. Ahead of us looms the possible complete loss of 125 million acres of land and the partial destruction of a much greater amount.

We must not permit the same calamity to overtake us which overtook the Mayans. We shall have only ourselves to blame if we do. We know how to control soil erosion; the Mayans did not. We know more of the science of engineering than they. We presume they did not even know of terraces, since they left none. We know more of the science of agriculture. It is not probable that they ever conceived the idea of a cover crop or a strip crop, or of land slopes too steep for safe cultivation. Surely, they had no soil erosion experiment stations, nor a far-seeing Government to stage large-scale erosion control demonstrations from which they could learn methods of controlling soil losses.

In fifty years soil erosion caused the Mayan civilization to decline from its greatest height to the point of actual extinction. It has taken the American people just about that long to reduce some of the richest farm lands in the world to the point of being worthless. Destruction of some of our farms is complete. On many more erosion has progress to the point where the soil will no longer yield a profit on its cultivation. Isn't it time to apply what we know?

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Permanent Strip Cropping in California

By Harry F. Reddick
REGIONAL DIRECTOR VENTURA PROJECT

California rich citrus orchards being protected by bench terraces developed from permanent strips — adapting an idea from the ancients

In spite of the indisputable marvels of the ancients in constructing their elaborate systems of terracing, California has developed a method of successfully farming steep slopes that has all their good points and lacks many of their bad ones.

The successful and continuous farming of steep hillsides has always been a major problem to the agriculturist. Steep slopes, ranging from twenty to fifty per cent in grade, have been utilized for crop production since long before the white race first practiced systematic cultivation of the land, but the methods of adapting the hillsides to production invariably called for an expenditure of labor that would be prohibitive to the modern American farmer.

The Germans, in the fertile valley of the Rhine, terraced the banks up slopes so steep that the retaining walls of the plots often had more area than was made available for the growing of their grapes. The Chinese have long grown rice upon the stair step hillsides that sweep upward from the rivers. The ancient Incas of Peru (likely one of the most highly advanced agricultural people this planet has ever known) carried on their farming with a fervor that bordered on fanaticism, and built one of the most elaborate and most lasting systems of terraces of which history has any record. So succesful and so foresighted were these inspired builders of land that even today, after four thousand years of continuous cropping, the same plots are supporting their descendants.

Such grand methods of land usage were not without their cost.

Walls of perfectly joined masonry, six to twelve feet in thickness, and eight to twenty feet in height, were constructed by man power alone, in order to retain an area seldom exceeding a fraction of an acre. Single stones 36 by 24 feet in area and six feet thick are to be found in the walls constructed by that ancient race who had only man power, a keen appreciation of the power of leverage, and boundless energy to assist them. It is said that good rich earth was packed seven hundred miles on the backs of spindly legged llamas to carpet those precious mountain side plots which were often so small that only two rows of potatoes could be planted in their entire width.

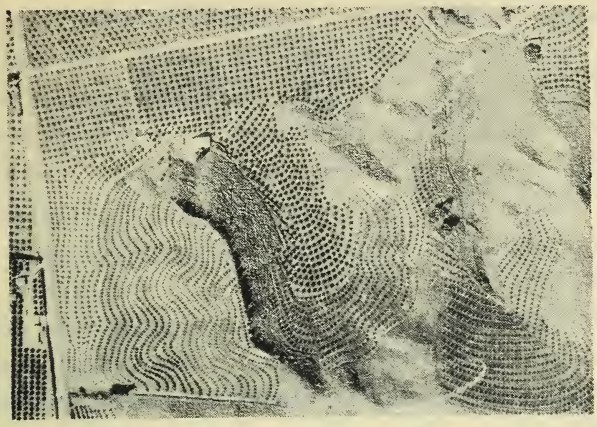
Obviously no such methods can be used by the American farmer today, but the need of terracing on the steeper slopes is just as acute, and just as essential, if they are to be successfully cropped throughout a number of years. In California the ranchers (all farmers are known as ranchers in the West) long ago discovered that the steep slopes were often the best adapted to growing of citrus fruits, avocados, and many deciduous fruits. The hillsides were preferable, because of the deeper and richer topsoil, because they were warmer in the winter and less subject to killing frosts, and were usually freer from diseases and pests.

The question of planting orchards on steep slopes was aggravated by two primary necessities: the soil must not be carried away by erosion, and there must be sufficient grade for irrigation. It was these conditions that proved the need of an engineer specializing in

Bench terrace that has developed due to permanent strip cropping and cultural practices in an irrigated orange orchard. Note the heavy growth of vegetation on the steep bank.

agricultural problems, and such has been the author's work for the sixteen years prior to entering the Soil Erosion Service.

The first step taken by the agricultural engineer in designing a hillside orchard lay-out is the making of a topographic map having a scale of 1" equal to 100', with contour intervals of from 0.5' to 2', depending on the terrain. Such contour maps are usually obtained in the fall of the year after the annual crops have been harvested. Following the completion of the map a paper layout is made of the proposed orchard, showing the tree rows laid out on suitable grades to give the water a uniform distribution. Due to the fact that conditions vary from field to field, the grades of the irrigation contours range from 1% to 4%. On this map there is also indicated the irrigation lines, drainage lines, roads for future use in hauling fruit, and all other necessary features that will aid in efficiently farming the land.



Irrigated contour citrus orchard in California where bench terraces developed from permanent strip cropping.

The following spring, from February to May, the paper lay-out is staked out on the site of the orchard, and when the job is complete there is a stake for each and every tree, pipe line, irrigation head, gate valve, overflow, catch basin, and outlet. The construction work is then started and the trees planted.

Before the completion of laying out an orchard the writer always advised the rancher to cultivate only on the contour, and never do any cross cultivation under any consideration. He was further advised to leave the strip of grass cover crop and weeds in the tree row intact. If the weeds became too tall he was advised to cut them with a scythe, but let the litter remain where it fell. This practice has been adopted by a large number of ranches throughout California, and the results have proven very satisfactory.

In a few years the shape of the hill changes gradually from that of a uniform slope to one composed of a series of "falling terraces." It has been found that there is a definite movement of the soil down hill toward the tree row regardless of whether the old-fashioned side hill

plow is used or the cultivating is done with tractors and heavy double disc harrows. Each succeeding cultivation tends to steepen the slope or "riser" between the terraces, and after ten years of such practice there has been formed the definite bench terrace.

The advantages of bench terraces are several. It provides the rancher with a terrace which has a flat cross slope plus the desired irrigation grade. There he can place his irrigation furrows, from four to six to a space, and he can use wagons for hauling his fruit out of the orchard instead of sleds. An additional advantage of such cultural practice is that he can plant his winter cover crop on the terrace and by irrigation have it up before the winter rains set in, thereby preventing any erosion that the storms would ordinarily cause. These cover crops furnish excellent green manure when disced under the following spring.

The leaving of the grass in the tree rows is nothing more or less than establishing a permanent strip crop to prevent runoff and soil erosion. Records and measurements of eroded material have been kept on a five-acre contour lemon orchard for several years, and in spite of the fact that during that time two storms of near cloudburst proportions have occurred, the average soil loss has been less than fifty pounds per acre per annum. The runoff, although not measured, was equally small.

It is interesting to note that while the original cross slope of the tract referred to above was from 25% to 40% there has never been a rill, rivulet, or gully come down its slopes. This is in no sense an isolated case as can be testified to by hundreds of ranchers in California who have plotted and tilled their orchards by the method herein described.

Erosion control as practiced by the Ancient Peruvians. Detail of bench terraces in the Colca Valley.

Thus it is that the modern California rancher obtains all of the advantages of the terraces built by the ancients plus many that they did not have, and he does it at a cost within reason, and without the use of tens of thousands of toiling slaves that fenced their soil with huge blocks of stone.

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Before Villa's Firing Squad

By G. A. Barnes

SPECIAL ASSISTANT TO THE DIRECTOR

A little known chapter from the life of J.G.Lindley, who escaped, of course, to become Supervising Engineer for the E.C.W. Camps of the Service....

Behind me, the door marked "Supervising Engineer ECW Camps" swung shut with a faint click, and Lindley looked up from a pile of papers in front of him. He smiled, and I felt a little better about interrupting a busy man at the end of a busy day. I told him what was on my mind.

"Well", he said, "if yuh really want that story I guess I'm hooked. But you sure must be hard up for copy this month."

He started off with biographical detail, and I took it all down very dutifully, though it wasn't what I'd come for. He was born, Lindley said, in Moberly, Missouri, in 1888. That made him only 46, and I was surprised because he looks about 40 to me. I wasn't surprised, a moment later, though, when he sketched an outline of his 46 years...University of Oregon, University of Arizona...surveyor, chemist, metallurgist engineer, superintendent of mining camps in the Southwest and Mexico...the Chemical Warfare Service in the War years.. a construction job with peons and Indians in tropical Sinaloa. I started to ask how he managed it all in 46 years, but he was getting to the story I wanted so I didn't interrupt.

He tipped his swivel chair back as far as it would go, locked his hands behind his head, and grinned reminiscently. I was set to hear a chronological account of the incident that interested me, but Lindley began to ruminate.

"Under the circumstances", he said, meditatively, "the traditional devil-may-care attitude was something of a strain. Leaning against that adobe wall, I pretended extravagant indifference toward death, because extravagant indifference seemed to be the formula for such situations. Also, there was a certain satisfaction in irritating the pompous gentleman who had things undeniably in hand. We all tried to maintain the customary Yankee coolness, but the sight of those eight highly efficient cut-throats, hand picked for our execution, was

just a trifle disconcerting. Even a Villista firing squad is apt to quite accurate at ten paces, you know."

I didn't know, but I could imagine. Lindley stopped and swung around to look at me.

"I'm putting the cart before the horse, though. Suppose I start at the beginning and let you in on the events leading up to the tragedy, or rather, that almost led up to the tragedy."

I nodded agreement.

"Mexico in 1914 and 1915 was a pretty hectic place", he went on, "what with an elusive Villa and an exasperated Carranza letting blood all over the country-side. I was engineer and assayer for the National Mines Company in Durango, and I was very young. I had little on my mind but hair, and not much more of that than I have now.

"Villa had been defeated at Agua Prieta, and the United States Government had permitted Carrancista troops to go in bond across American territory to help repulse him. It made Villa regard all Americans as enemies. After he was beaten, he broke his army up into raiding bands of 60 to 70 men, placed them in the command of generals, colonels, and assorted other officers, and sent them south with blanket orders to tear up railroads and kill off "gringoes".

"William Jennings Bryan was Secretary of State in those days, and realizing that Villa meant business, he ordered all American mine employees out of Mexico. Anyone with half a care for his skin would have obeyed, and most of our fellow-workers did. But I was very young; I guess you might say I was just a trifle foolhardy. Anyway, I agreed with four other youngsters to stick around and take my chances.

"We spent the next several days and nights ducking into hiding and out again. Every rumor about Villistas on the raid -- and there were rumors a-plenty, believe me -- sent us scurrying for cover in the mine. We were ninety miles by stage coach from the nearest railroad, and we were five peace-loving Yankees against an army of blood-thirsty villains.

"For a while, we were lucky. Then, one day, a roving band took us by surprise, in broad daylight. We weren't even hiding. They descended upon the camp suddenly and corraled us very neatly, indeed.

"The five of us were hauled at once before a pompous, pseudo-military gentleman who turned out to be General Pedro Bracomontes, one of Villa's trusted henchmen. We were searched and relieved of the few valuables we had, even down to hats and boots. In stockinged feet, we stood there while the General delivered himself of varied thoughts about America and Americans. He was, I think, the greatest master of invective I have ever met. He approached the matter of insulting us

with a care and delicacy hardly short of the artistic. His vocabulary was colossal and, for some fifteen minutes, he let us have it with both barrels. Calmly, then, he sentenced us to be shot."

Lindley grinned -- that quizzical grin -- and continued.

"Eight genial blackguards formed a squad about us. At a command they marched us away, down through the terrified town and across a long mesa to an old *almacen,* or warehouse. There, against the old adobe wall, we lined up, the five of us, side by side. It was hard to appear nonchalant and casual; one wanted to yell in protest. But the tradition was strong. We tried to look indifferent, even if we didn't feel that way. With the business end of eight Army rifles staring coldly at you across ten feet of ground, it's only natural to be concerned.

"Then, suddenly, the pompous colonel in command of the squad approached us with his proposition. He realized the international consequences likely to follow our execution, he said importantly, and he was anxious to avoid them. Naturally, it was his duty to carry out the order of General Bracomontes. But a tangible consideration, he suggested, might persuade him that our lives should be spared in the interest of international harmony.

"Greedily, we began to negotiate. One thousand silver pesos? we suggested. The colonel scoffed. Fifteen hundred? we countered. Again he scoffed. Two thousand -- virtually all we had between us in the world? Well, he would consider. He wrangled for another two hours and finally agreed. For two thousand pesos he would turn us free. We scraped it up from our savings back at the mine, and handed it to him. The firing squad lowered its rifles, formed, and marched away, our friendly colonel leading a pack mule laden with the monetary fruits of our many months' labor in the mines of Durango.

"Just as I can't describe the sensation that came over me when I found death staring me in the face, so am I unable to describe my feelings when the colonel and his men departed. I say frankly that I was scared stiff. What I needed, I decided was a drink. My companions agreed lustily. We dashed for the nearest *cantina,* and you can be certain I never enjoyed a stiff slug of mescal as much as I did that day."

Lindley halted with an inflection that meant he had finished, but I was not yet satisfied. What became of Bracomontes, I asked. He was killed shortly afterward in a battle near Durango City, Lindley replied; and I could detect no sympathy in his voice.

Which, I reflected, was hardly odd.

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THE DISINTERESTED OBSERVER

The Press and the Public
speak their minds about the S.E.S.

EXCERPT from address of Louis J. Taber, Master, National Grange, opening annual convention, Hartford, Conn.:

"There is no better way to use funds if they are wisely and economically expended, than in demonstrating to the American farmer practices and methods that will enable him to operate his farm and prevent, as largely as possible, the loss from erosion by runoff water. This program of the government is but a drop in the bucket. Six million farm homes must become centers from which radiate sound information on the preservation of our soil and its fertility...This fertility does not belong to those alone who hold the deed to the farm. It is not the wealth of this generation; it is the property that belongs in part to those who will live in the centuries to come." (Nov. 14).

ARTICLE in Baltimore, Md. SUN:

"Probably the most important conservation program that has been sponsored by the Roosevelt Administration is now being carried forward in most of the states by the Soil Erosion Service of the Department of the Interior." (Nov. 25).

ARTICLE in BARRON'S, The National Financial Weekly:

"Gloomy, indeed, would be the outlook for the nation if erosion could not be controlled, but it can be if the people are disposed to do it...The condition will go progressively worse until the nation awakens to the fact that its existence depends upon effective means taken to control the erosion and preserve that 7 inches of soil that stand between it and ruin." (Nov. 12).

EDITORIAL in the WALL STREET JOURNAL:

"The question of erosion is beyond the discussion stage...It affects the means of human existence. To permit it to go on unchecked is to trifle with a national menace."

EDITORIAL in the NEW REPUBLIC:

"One of the most hopeful projects of the PWA is the Soil Erosion Service. It has only a $10,000,000 fund to combat a process that is costing American farms something in the neighborhood of $400,000,000 a year, but it is a determined step in the right direction and it sets a precedent that may in the future become a normal, nationwide service." (Nov.14).

LETTER from Walter R. Humphrey, Editor, Temple, Texas DAILY TELEGRAM:

"Through the work which has been done in this section of the state under the able direction of H. V. Geib, the farmers of Central Texas have been given a new vision and a new hope, which is going to reflect untold improvement on farm values and farm revenues. The farmer of Temple, Texas, swears by the Soil Erosion. Never before has the Government come to him with such valuable assistance. I think the value of the work already done will be a lasting monument to the New Deal, to the President, to you, and to your associates."

EXCERPT from address of Edward A. O'Neal, President of the American Farm Bureau Federation:

"We must formulate and apply a national program of land use to correct the unsound policies of the past and protect our greatest natural resource -- land." (Dec. 10).

EDITORIAL in the Minneapolis, Minn. STAR:

"A large erosion control project has been instituted near Winona...and thus moves in the Governmental program to improve agricultural conditions through conscious application of scientific means.

"Erosion control is a big factor in Agriculture...America has reached the point where her agricultural resources must be protected and rehabilitated; waste must be replaced with conservation." (Oct. 20).

ARTICLE in the Silver City, N. M. Enterprise:

"...the work being done by the Soil Erosion Service in Arizona and New Mexico will undoubtedly result in the restoration of many thousands of acres to their former fertility and grazing value.

"One of the principal benefits to result from the control of erosion will be the decreasing of the amount of silt carried down by the Gila River to lodge behind the Coolidge dam."

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Many Special Problems in Texas Blacklands

By H.V. Geib

REGIONAL DIRECTOR TEMPLE PROJECT

THIRD IN A SERIES OF ARTICLES
ON PROGRESS OF THE PROJECTS

Central Texas Erosion Control project is located in the Elm Creek Watershed with headquarters at Temple. The size of this area is approximately 200,000 acres and lies partly in four counties.

The Texas Blacklands comprise an area of approximately 11 million acres, and occupy a relatively narrow strip extending in a general north and south direction almost completely across the state. The topography varies from gently undulating to broadly rolling and hilly. The average slopes range from 3 to 6 percent, but there are considerable areas where the range is from 10 to 15 or 18 percent. The Elm Creek watershed is quite typical of the entire Blacklands

The soils of this watershed are all clays, derived from limestone, and are highly calcareous. Many of the samples analyzed show a calcium carbonate content of as high as 65 percent, and some of them have well over 50 percent in the colloidal fraction.

The rainfall of the area averages around 36 inches per year, but it is usually very unevenly distributed.

The ElmCreek project was set up in December, 1933, but very little actual field work was accomplished until the latter part of the winter, due chiefly to bad weather conditions. The character of the soil makes it impossible to do any kind of field work for a considerable period after heavy rains.

Greater part of the area was originally a treeless prairie and at the present time approximately 90 percent of the land is in cultivation. The average size of the farms is approximately 110 acres. The majority of the farms in this region have been cropped for from 65 to 75 years and in this comparatively short period of time erosion has made tremendous inroads on the fertility of the land.

TYPES OF WORK BEING DONE

While an effort is being made to put into effect all practicable methods of erosion control, it has been necessary to take into consideration quite a number of important factors and conditions which are not common in other parts of the state. These conditions tend to make

the Texas Blacklands unique in the methods of erosion control which are effective and practical to put into operation.

The effect of vegetation on erosion control has been amply demonstrated, and this fact has not been overlooked in our program. In our gully-control work, vegetation is used wherever possible. Bermuda grass has been found to be the most satisfactory plant in this respect. A great many farmers object to its use in their cultivated fields, as it is so very agressive and so difficult to control that it is likely to become a menace on cultivated land. There is usually no objection to its use, however, in gullies in pastured areas, or in the creation of new pastures on badly eroded hillside areas.

There are a few other grasses which give promise of being effective in erosion control, but a sufficient quantity of these cannot be found in this locality to utilize to any great extent. A 15 acre nursery has been established where we are propagating Dallis grass (paspalum dilatatum), and a few other grasses which we think may be successful. This nursery is irrigated.

Cotton is by far the most important crop in the region. It is better able to withstand the long summer drouth than any other cash crop and it can be readily sold at any time during the year. The principal other crops have been corn and oats, with some sorghum, cane, grain sorghum, sudan grass, and a very little wheat. From the standpoint of erosion control this is about the poorest possible cropping system. It means that from 75 to 90 percent of the crop land has been in row crops year after year, which has resulted in a depletion of the supply of organic matter and a tremendous loss of the surface soil. The general practice has been to run crop rows down the slope, and this of course has been responsible for great soil losses, as well as loss of much needed rainwater. In this region a sufficient supply of moisture is the most important factor in crop production. We have many instances where simply contouring the rows has more than doubled the yield of cotton and corn. This has been due not only to the saving of rainfall, but also to the saving of nitrates which are carried off so readily with the runoff rainwater.

Whenever practical, strip-cropping is being recommended. There are, however, quite a number of factors which tend to discourage this practice. On account of a fungus disease commonly known as cotton root rot, which is prevalent in most of the black soils, and which attacks practically all leguminous crops, it is usually not practical to recommend the planting of any legumes except those which make their growth in the winter months. At this period of the year the root-rot disease is not active. Small grains are therefore practically the only crops which can safely used as the erosion-resisting crop.

During the long summer drouth large cracks commonly occur in our heavy clay soil. When rains come they follow these cracks through strips of thick growing crops and even through well-established pastures and, where this condition occurs, gullies form rapidly regardless of the type of vegetation on the land. Long seasons of drouth render ineffective, from the standpoint of erosion control, practically all types of vegetative growths. During such seasons pastures become grazed down so that the ground is almost bare, and when heavy rains occur there is not enough vegetation to offer much resistance to the flow of water. We believe that strip-cropping will be most effective in this region when combined with an adequate system of terracing. Terracing alone does not give sufficient protection on the steeper slopes, but when combined with strip-cropping, is the most effective of all methods applicable to this region.

We like to lay off the strips, both when strip-cropping is carried on alone and in combination with terraces, in such a way that the irregularities of the field are taken care of by the strips so that there are no short rows in the cultivated crop. This removes one of the greatest objections most farmers have to terracing or contouring.

We are not recommending contour farming without the reinforcement of terraces or strip-crops, except on land having a slope of less than one percent, as in this region there is grave danger of serious gullying if such a practice is followed.

FARMERS DO TERRACING WORK THEMSELVES

On this project all of the terracing work is done by the farmers themselves, with the Service furnishing light terrace graders and fresnoes. We fell that in this way the farmers will have a thorough appreciation of the terraces, and will feel a greater responsibility in maintaining them. Furthermore, it not only teaches the farmers how to do the work, but it also demonstrates to those in the surrounding areas that they can do this terracing work at almost no expense to themselves -- an important factor in this region. This also means that the greater part of the S.E.S. funds will be paid out for labor, rather than for heavy equipment. At the present time the project has about 560 men on its payroll, besides approximately 500 World War veterans in the two ECW camps.

Old pastures are being terraced where the land is exceedingly steep, and contour-furrowed where the slopes are not excessive. This contour furrowing usually consists of plowing back-furrows on the contours at intervals of from 10 to 20 feet, depending upon conditions.

Terrace outlet control is largely taken care of by the two ECW camps under our supervision. These camps are building mostly permanent structures, chiefly of concrete, since suitable rock is scarce here.

These camps have to date completed in the neighborhood of 1600 permanent dams. The cost of these is not as high as is generally presumed. Considering that the farm land is worth at this time from $75 to $150 per acre, the cost of this much needed protection is not at all out of proportion to the benefit derived therefrom.

In a great many cases we have been able to empty our terraces upon pastures which are already established, or on areas where we are now planting pastures. A great deal of care has to be exercised in this practice because where the water is concentrated it takes a heavy stand of grass to keep the soil from washing badly. Where several terraces dump into the same outlet ditch it is usually necessary to build permanent structures since it is almost impossible to get vegetation to hold satisfactorily under conditions common to this area.

Up to December 8, 610 cooperative agreements have been signed, which cover a total area of about 67,000 acres. Work has been started on approximately 400 farms. To date more than 1700 miles of terrace lines have been run, and about 700 miles of terraces completed.

When work on this project was inaugurated, not over 1 percent of the area had any means of erosion control. Most of the farmers were backward about subscribing to our program. It was therefore necessary to put forward a great deal of educational work, the response to which has been exceedingly gratifying. In one section of the watershed more than 95 percent of the farmers have signed agreements. A great many who at first had no interest at all in the work, and who vowed that they would never cooperate in such a program, are now voluntarily coming to the office and asking that the service be extended to include their land.

This general attitude seems to be sweeping the entire state. More and more interest in erosion control is continually being evidenced from all quarters. Inquiries are received almost every day from various parts of the state asking in what way their region might obtain assistance in working out their erosion control problems. One watershed has submitted a petition carrying more than a thousand signatures, pledging approximately 95 percent of the land in the watershed. The unanimous expression is for continuance of the work.

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A series of soil terms, with their meanings, is being carried in each issue of the *Navajo Project News*. It has been compiled by A. T. Strahorn, Chief Soil Expert of that project.

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BY WAY of BIOGRAPHY

Walter C. Lowdermilk

Vice - Director

a real old-time scientist...a young man...world authority on erosion and runoff problems...born in North Carolina, July 1, 1888...studied in Park College...then University of Arizona...became an Oxford scholar....later studied in the University of California where he took his Ph.D...a forester with many years experience...used to sleep out in the open range and still likes plenty of fresh air...had practical training in the state forests of Germany and France...in charge of timber acquisition in the A.E.F...member of special commission in Paris to assist the American Peace Commission ...selected by the University of Nanking to study conditions in China ...his observations and discoveries gained widespread recognition... narrowly escaped death in Nanking when attacked by communistic element... member of numerous professional societies...delights in and is proficient in coining new soil erosion phrases...writes often and technically...loves his work and is intensely interested in the West...married, two young children ...sometimes gruff, sometimes abrupt, yet somehow, always courteous...

Farm Management in the Erosion Control Program

By E. H. Reed

AGRONOMIST OHIO PROJECT

The Soil Erosion Service must be so devised as to increase farm incomes as well as save soil and water. The farmer is usually more interested in immediate financial returns than he is in saving soil for posterity. If we are to continue to receive his support and co-operation, we must be able to prove that the program is practical and profitable from the immediate as well as long time viewpoint.

In working out the program for the individual farm, careful attention should be given in putting each field to its most practical and profitable use from the standpoint of farm management as well as from that of soil and water conservation. The farm program must fit the farmer's needs and give him the proper combination of enterprises for the greatest profit. This, therefore, places a grave responsibility on those in charge to see that a logical program is worked out for each individual farm. If this is done, there is little doubt but that the farm may be made to afford a larger income at the same time that soil and moisture is being conserved.

The next step is to be able to prove whether or not the program is profitable. In the Salt Creek Area, an attempt is being made to do this. A farm management survey is being taken on each farm at the time work is started. This survey shows the farm management plan and the labor income before the program was begun. A large percentage of the cooperating farmers have agreed to keep general farm account records in cooperation with the Soil Erosion Service. At the end of each year, these records will be analyzed to show whether or not progress is being made and whether the income has been maintained or improved. Methods used and results obtained on the more profitable farms will be compared with those on the less profitable to determine why some farms pay better than others. This information then will be used in educational work with the farmers.

Incomes will be correlated with soiltype and degree of erosion in order to show the effect of erosion on labor incomes. This information will be used to show the farmers the importance and desirability of erosion control.

A research project is also being planned in which a historical study will be made to determine causes of erosion as effected by man, and the resultant economic and sociological effects.

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(Continued from Page 5)

channel; (b) insufficient gradients which cause the choking of the channel in places; (c) excessive distance between terraces, with consequent increased soil loss from the inter-terrace; and (d) improper construction such as results in excessively high places in the channel or low places in the ridge.

Terrace outlets that are improperly protected may cause serious erosion and result finally in gullying. Numerous big gullies in terraced areas can be traced to concentrated discharge from the terrace system on unprotected slopes, or into channels that were not adequately protected. Once a gully is started in the outlet channel, an overfall is created for the water entering from the terrace, and this will result in a progressive gully extending up the line of the terrace.

To overcome the dangers of improperly constructed terraces and terrace outlets, the Soil Erosion Service is attempting to make each terrace as nearly perfect as possible. The inherent dangers are anticipated and provided for as fully as may be possible. Points of danger resulting from improper construction are carefully checked and the defects corrected before the system is pronounced complete. Prepared terrace outlet channels are protected with vegetation or structures or a combination of both. Wherever possible, safe natural outlets are used, with the discharge onto pasture sod, thick-growing timber lands or into natural swales or depressions that can be protected with a permanent sod.

Terraces require some maintenance, and cooperators are taught the necessary procedure. Maintenance is ordinarily performed by plowing out the channels so that the furrows are turned to the ridge with the water or dead furrow falling in the lowest part of the channel. This process deepens the channel three or four inches and is necessary for the first few years, or longer, after the terrace is completed. The process is adequately shown in the illustration.

Other maintenance measures include filling breaks that may be caused by overtopping, or by low places resulting from settlement; removing silt from channels either by plowing, as illustrated, or by use of slip scrapers or blades.

COORDINATION WITH OTHER CONTROL METHODS

Terracing must be coordinated with other control measures. It is only in this manner that maximum control from cultivated areas can be achieved. Records of experiments show that terraces perform a ser-

viceable function in prevention of erosion on certain adaptable lands. The records also show that the soil loss from heavily vegetated land is reduced to a mere fraction of a ton per acre. The introduction of close growing vegetation in connection with terraces is advocated by the Soil Erosion Service as the only effective method of reducing erosion losses to a minimum. The vegetation may be placed in the form of strips to be located between or on the terrace ridges; in rotations that utilize an erosion preventive crop at least one year of the rotation period; or seeding slopes to permanent pasture. Improved cultural practices that tend to keep the soil in a high state of absorptive capacity is also a highly valuable part of soil conservation.

In designing the terrace system other factors than runoff and carrying capacity of the terraces must be considered. For instance, soil characteristics, land use and cultural practices should influence the terrace design. Gully control work also will often influence the design or vice versa, since the terrace system frequently can be used to divert water from a gully and thus materially reduce the cost of its control. Occasionally a convenient gully can be used as an outlet making construction of the terrace system less expensive.

CHANGING ATTITUDE TOWARD TERRACING

The practice of terracing agricultural lands was for a great many years the only widespread effort made towards controlling erosion. This resulted in a fallacious assumption on the part of many people that the construction of terraces was the only control method necessary. With the acquisition of new knowledge about erosion control, gleaned from scientific experimentation and study, however, this idea is rapidly undergoing a change. We have learned that vegetative measures of control are highly effective and that terraces can only be one factor in a properly coordinated program of control. The practical application of this new concept of terracing can be seen in recent activities on the part of Federal and state agencies, individuals, and cooperative organizations.

PART TERRACING PLAYS IN SES PROGRAM

Construction of terraces and terrace outlets is one of the activities of the Soil Erosion Service. Equipment adapted to varying conditions found on the several projects is being used. The Temple, Texas project uses light horse-drawn or farm tractor propelled blade graders satisfactorily. In the South, Southeast and Central West, the tractor operated blade grader with 8 to 10 foot blade has proven economical and is being used almost exclusively. In Kansas and Nebraska, the elevating grader and heavy tractor give better results. A

small supply of light horse-drawn blade terracers and terrace drags is available on all projects for use of cooperators in building their own terraces and in performing their share of the work to be done.

It should be understood that the Soil Erosion Service does not propose to terrace all the lands of any cooperator in one season. The terracing program provides that the work be extended over three or four years, which necessitates restricting the yearly service for a cooperator to about 25% of the total acreage to be terraced. This arrangement guarantees service to a maximum number of farmers. The cooperator is required to perform a certain proportional part of the work incidental to terrace construction. His work will vary on different projects but generally, he is required to fill all low places on the terrace ridge, open the ends of channels, harrow and smooth down the terraces and plant the ridges to close-growing, erosion-resisting crops. On other projects, he may be required to perform a specified minimum of work with the light equipment before the Soil Erosion Service begins operations with heavier equipment. In addition, the cooperator is also required to adopt other measures which will further reduce erosion, such as contour cultivation, strip-cropping and the rotation of crops to include close-growing, soil holding legumes or grasses.

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SOIL EROSION ASSOCIATION FORMED IN LOUISIANA

Believed to be the first of its kind in the nation, a Soil Erosion Association has been formed in Claiborne Parish, Louisiana.

It is the avowed intention of the association to go after a soil erosion project for that parish. A petition is being circulated throughout the parish, and latest reports are that a huge number of names have been attached thereto.

As reported by the "Brushy-Cooley-Cypress Creek News, the service bulletin of the Minden project, officers of the Claiborne Association are keeping in close touch with the work on Project No. 15. They state that the more they see of the work, the more determined they are to expend every possible effort to secure such work for their own parish.

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J. G. Lindley, Supervising Engineer of ECW work for the Soil Erosion Service, left Washington Dec. 15 for an extended inspection trip of all CCC camps under direction of the Service.

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Wind Erosion Endangering Colorado Vegetation

By C. J. Whitfield

CHIEF OF RANGE MANAGEMENT GILA PROJECT

Throughout eastern Colorado striking vegetative changes are taking place in the native grass land as a result of wind erosion. At present the sod grasses, gramma grass, *Bouteloua gracilis*, and buffalo grass, *Buchloe dactyloides*, are the principal range species.

There has been a decrease in density and height of the present native vegetative cover as a result of recurring droughts and serious overgrazing. In some areas dead plants of grama grass were observed, death undoubtedly being due to the drought. Density has been so reduced in many areas that the various textured soils have begun to blow. It is not uncommon on range lands to see the soil set in motion by gusts of wind and trampling of stock. Regions have been observed where native sod has been entirely blown out of the soil. On the sandy and sandy loam soils that predominate over eastern Colorado, soil blowing exposes roots and smothers entire plants by the deposition of wind-blown material.

Large tracts of marginal and submarginal land in eastern Colorado were cultivated during the World War and the years following. The breaking of native sod, together with drought conditions, resulted, within a few years after plowing, in serious destructive wind erosion. Over large areas the soil has been completely denuded of the A-horizon, exposing the heavy adobe clay pan. This blowing is not by any means confined to coarse textured soils, but occurs with the same degree of intensity in fine textured ones as well.

The carrying off of the finer soil particles by the wind and the leaving behind of the coarser materials are some of the most serious results of cultivation and overgrazing. The continuous blowing and piling by the wind of this coarser material has in some areas exposed roots and in others smothered entire plant communities. This exposure and covering of native vegetation is becoming of serious importance in eastern Colorado.

The windblown material is deposited against existing barriers -- houses, fences, barns, windbreaks and the like. One of the most common barriers is the Russian thistle plant. It has spread from cultivated and abandoned fields in all directions, and become lodged on range land and along fences.

The first effect of the deposit of windblown material is the decrease in density of the cover. Buffalo grass with its surface runners is damaged more than gram grass with its underground parts. As the depth of the deposit increases, native grasses are damaged until only a few remnants appear. Finally a large area of range land is covered, and Russian thistle dominates what was formerly a short grass plain. In some sections the area has been desolated, with windblown material covering range land, fences, and partially covering barns and houses. In sandier areas bur-nut, *Tribulus terrestris*, replaces Russian thistle, and in some sandy loam areas purslane, *Portulaca oleracea*, predominates. Near Las Animas, almost the entire native grass cover, consisting primarily of grama grass, has been smothered out and only huge hummocks of *Yucca* remain. In another section nearby, sands have been set in motion, active dunes are formed and even now are moving over and destroying large areas of native vegetation and endangering buildings and cultivated areas.

Windblown material has almost covered this farmhouse in Eastern Colorado. Salix on the left has been buried to a height of seven feet.

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DRAFTING SECTION

Since the dawn of civilization men have dreamed, planned and completed works to extend and make secure that civilization. The earliest dreamers had to proceed by trial and error until a body of knowledge and experience was built up from which others could drae to plan their works with greater assurance of success and less waste of time and material.

Men still dream and plan. But today they can crystallize and translate these dreams and plans into a medium which others can read, understand, and augment from their own knowledge. At the side of the planner -- his translator into reality -- stands the draftsman.

From time immemorial, pictorial representation of ideas has been the easiest method of assimilation, and the draftsman, its exponent, is an invaluable and integral part of any organization entering anew undertaking which requires the coordination and cooperation of many people.

The Drafting Section of the S.E.S. has sought to present an accurate, forceful representation of the composite best thought and experience of the personnel of the Service. It is at present engaged in the compilation of various types of data gathered from all available sources for use in both field and office. As the field forces gather further and more exact information in our comparatively new line of endeavor, the department will be the instrument of correlation. The best available known methods of combating erosion are being worked up into standards to be adapted in the field to each individual case. Slides have been prepared for lecture purposes, to present clearly the need for erosion control. We are acting as a clearing house for aerial survey prints and as preceptors in their uses. Countless charts and miscellaneous maps have been worked up, and standardization of drafting methods in both field and office is being effected. All the art and poster work incidental to such a program as ours is being handled by this department. Reconnaissance Erosion Survey maps of every state have been reepared, and tabulations made of all types of erosion in each state.

In the Land of Cotton

Continuing our series of exhibits displayed by Soil Erosion Service projects this fall, we show here what the visitors to the Louisiana State Fair saw. It was prepared by the Minden project under direction of Mr. Mims.

And Out Where the Tall Corn Grows

And here is the exhibit prepared by the ingenious force at Albion, Nebraska, where R. L. von Trebra is Regional Director. "A deed to the land won't save the soil," the legend warns.

A Symposium on Pastures

By Lyman Carrier

CHIEF OF THE BRANCH OF AGRONOMY

Two full days of papers and discussions at the annual meeting of the American Society of Agronomy held in Washington, D. C. November 23-24 were devoted to a symposium on pastures. It was a splendid and worthwhile program from start to finish. Never before has there been so much interest evidenced in the grazing problems by the American Agronomists. Experimental work is under way at a dozen or more experiment stations. Some of these experiments have not progressed beyond the lawn-mower clipping stage. Several states, however, notably Connecticut, New York, Pennsylvania, New Jersey, Ohio and Missouri have comprehensive pasture investigations under way where actual grazing by animals is being studied.

A marked advance in grazing thought could be noted at these meetings. Instead of impassioned tirades on the sins of overgrazing there was a general recognition of the necessity of close, even, grazing to keep pasture plants in a vegetative condition for best results.

Many chemical analyses have been made of pasture grasses in various stages of growth which show that a greater production of protein per acre is realized when the grass is harvested at the most palatable stage for animals, that is, two to four inches in height, than when left to mature for hay, although the hay yield is much larger in pounds of dry matter per acre.

One speaker emphasized the need of using the best soils for pastures. That, to be sure, is a new idea for this country. Fertilizer experiments with pasture sward give the same contradictory results that they show with other crops. Phosphorus gives the best results under practically all conditions. Potash with phosphorus is helpful in promoting the growth of legumes. Nitrogen was the bad boy of the experimental school. In some experiments, notably those under way in Pennsylvania, applications of nitrogenous fertilizers gave marked increases in production. Other experimenters reported actual depressed yields for the total season's growth from the use of nitrogen. Lime alone in most cases is not very effective but used with phosphorus and potash may be beneficial. A number of experiments noted that herbage from fertilized areas was more palatable and richer in essential food constituents than that from unfertilized soils.

Some confusion of results was due to the fact that the experimenters were dealing with diverse conditions. The best procedure for the production of a permanent bluegrass-white clover sward might not give the most profitable results with a rotation pasture of only a few years' lay.

It is hoped that the A. S. A. will publish all of these papers and devote another session to this very important subject three or four years from now.

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This formerly fine bluegrass pasture near Bethany, Missouri, is being cut to ribbons by gullies.

SOIL SURVEY GROUP INVITES MEMBERS

The American Soil Survey Association has for its purpose the exchange of ideas, discussion of problems, and the creation of interest in the study of soils as a natural body.

Since this is necessarily the basis of erosion control recommendations, the representatives of the Soil Erosion Service have been invited to become members. Meetings are held annually, and the proceedings, including papers presented, are published and distributed to the members. Applications for membership, together with remittance for two dollars annual dues may be sent to the Secretary-Treasurer, Dr. Austin L. Patrick, Department of Agriculture, State College, Pennsylvania.

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EROSION REVEALS ANCIENT POTTERY

While examining a shallow wash in a sloping field west of Lindale, Texas recently, one of the CCC workers noticed an unusual appearing formation on the ground at his feet. He kicked it with the result that it was partially dislodged and broken. Closer examination revealed that the object was an Indian pottery vessel, one of several which had been uncovered by the action of water removing the soil from the slope.

It was the custom of the Indians who inhabited East Texas before the coming of the white man, to bury with their dead, pottery vessels of food and water, which were to sustain the deceased on his journey to the Happy Hunting Ground. Such burials were of varying depth, according to the hardness of the soil, but most of them were three or feet or more below the surface. Most, if not all of them would have remained undisturbed for centuries to come had it not been for the clearing and cultivating of the land, and the consequent washing away of the soil which covered them.

Aside from the tragedy of the destroyed grave, it is interesting to consider the loss of soil which had occurred in exposing the burial. Even if the burial had been only two feet deep, which is certainly a minimum estimate, then two feet of topsoil, the most fertile and productive part of the soil, had been washed away and lost.

The owner of the farm upon which the burial was found is a cooperator with the Lindale project of the Soil Erosion Service.

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